

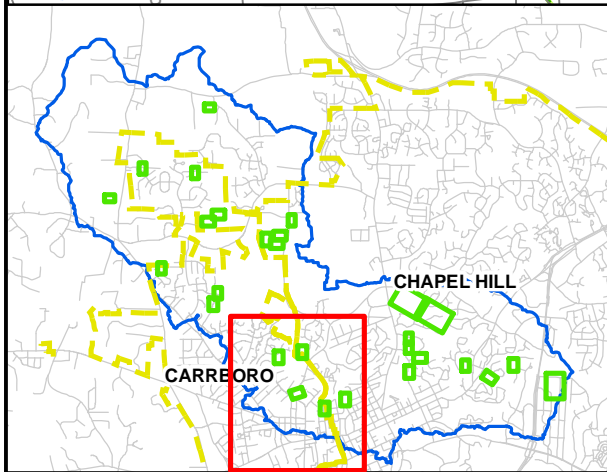
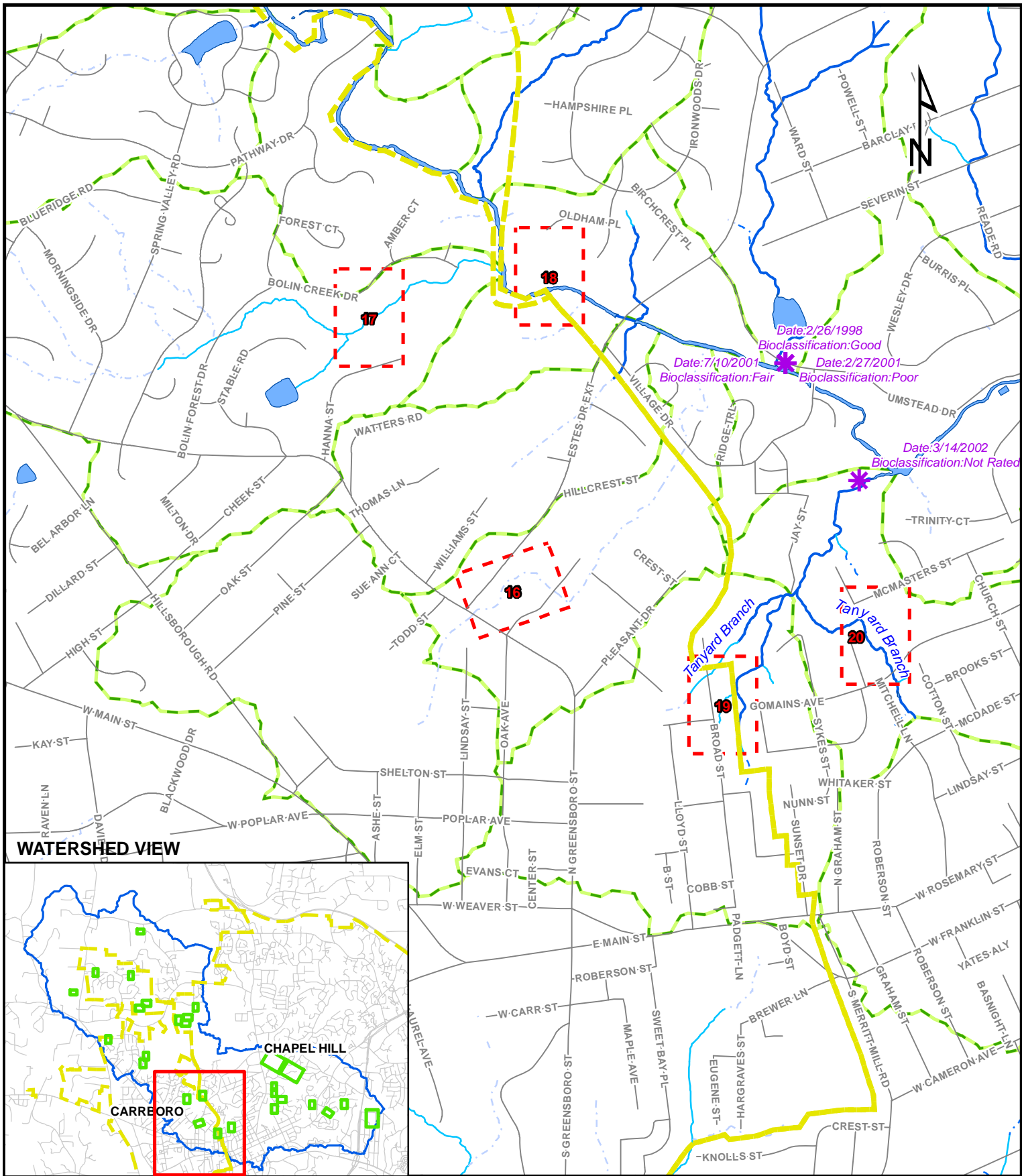
SITE 16

Stabilize Erosion at Apartment Complex and Provide Water Quality Treatment.

Index Sheet No.: 19
Raw Data Name: BD 47



Estimated Construction Cost: \$56,500 - \$86,300



Legend

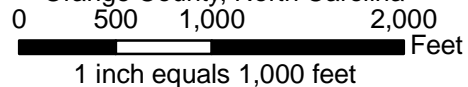
- Ambient Monitoring
- Benthic Monitoring
- Fish Sampling
- Municipal Boundary
- Orange County Roads
- Subwatersheds
- Perennial Stream
- Intermittent Stream
- Ephemeral Stream
- Stream, unknown flow



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**SITE 16
VICINITY MAP**

Geomorphic Analysis and Identification of Potential Sites for Stormwater BMPs
Orange County, North Carolina



Project Description

	Drainage Area (acres)	Impervious Area (acres)	% Impervious
Site 16	129.0	29.6	23.0%

Location

Site 16 is located just east of the intersection of Estes Drive Extension with N. Greensboro Street and is surrounded by an apartment complex.

Problem Description

Site 16 consists of approximately 500 feet of an incised, actively eroding stream, and small tributary that converges with the stream after passing through a culvert under Estes Drive Extension. Both the Carrboro and Chapel Hill stream datasets list the flow type as “Unknown”. However, based on the drainage area of 0.2 square miles and the position in the landscape, the stream appears to be perennial, though further verification is needed. The stream is surrounded on both sides by the landscaping and hardscapes of an apartment complex. A wooden footbridge passes over the stream near the midpoint of the problematic reach.

The chief problems at site 16 are active mass wasting banks, and considerable sediment export from the eroding stream banks. Using the BANCS model, it is estimated that approximately 200 tons of sediment are being exported from the site each year. Concomitant nutrient export has also been calculated and is listed in **Table 16.1**.

Table 16.1

Pre-Treatment	
Estimated Total Sediment Export	200.4 tons/year
Erosion per length of Channel	13.4 tons/yr/ft
Pounds of Nitrogen	400.9 lbs/year
Pounds of Phosphorus	200.4 lbs/year
Post-Treatment	
Estimated Total Sediment Export	0.7 tons/year
Erosion per length of Channel	0 tons/yr/ft
Pounds of Nitrogen	1.4 lbs/year
Pounds of Phosphorus	0.7 lbs/year

Proposed Solution

As with other bank stabilization/restoration projects, this site could benefit primarily from a change in the stream cross-section that provides the following:

- a bankfull bench that gives the stream a floodplain to access, thus significantly reducing shear stress and near bank velocities during above-bankfull events
- reduced slopes on the bank, at a maximum of 2:1, thus reducing potential for bank erosion
- vegetated banks with woody plants that will provide stabilization through rooting depth

By modifying the cross-section of the stream in this way for the length of the extreme eroding banks, the sediment export rates of this site could potentially be reduced to 0.7tons per year, with a corresponding reduction in nutrient export rates. Calculated sediment and nutrient reductions are shown in **Table 16.1**. The confinement of this site may force the designer to use relatively steep banks and no restored bankfull bench. However, laying back banks or using other alternative methods such as crib walls would be an improvement over the un-checked erosion that is occurring at present.

Constraints

Due to the highly urbanized location of this site, the chief constraint to this project would be the ability to acquire enough of a permanent drainage easement to implement the suggested treatment. Sloping back banks at a 2:1 ratio, yet keeping the existing depth of the stream at approximately 3.5 feet, would require moving back the banks laterally approximately 7 feet. In addition, landowners may not be amenable to construction equipment in close proximity to their apartment units.

Alternatives

Two alternative treatments could be implemented at this site, depending on size constraints and landowner cooperation.

In Alternative 1, the banks would be sloped back, a bankfull bench would be established and both would be vegetated. Brush matting on the banks will provide the necessary change in boundary conditions of the banks to resist the erosive force of peak flows. On the small tributary leading into the main stream channel, a step-pool should be built to stop the active headcut where the two channels meet.

In Alternative 2, the treatments recommended in Alternative 1 would be implemented, with the added water quality treatment of a bioretention area. The bioretention area should be constructed inline with the tributary and receive the flow of its contributing drainage area.

*Bolin Creek Watershed
Geomorphic Analysis and Potential Site Identification for Stormwater BMPs and Retrofits*

Cost-Estimate Breakdown

Tables 16.2 and 16.3 show a conceptual itemized cost estimate for both alternatives. These costs represent construction and maintenance costs only. The cost for the bioretention area is derived from a cost per cubic foot treated for bioretention areas as reported by Schueler, et. al. (2007).

Table 16.2
SITE 16 ALTERNATIVE 1

Pay Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Excavation	1800.00	CY	15.00	\$27,000
Bank stabilization with Brush Matting	630.00	SY	15.00	\$9,450
Site Preparation and Planting	0.13	Ac	7500.00	\$975
Silt Fence	750.00	LF	3.75	\$2,813
Boulders	25.00	Tons	200.00	\$5,000
Construction Safety Fence	550.00	LF	2.50	\$1,375
Construction Entrance	1.00	Ea	2500.00	\$2,500
Total				\$49,113
Mobilization (5%)	1.00	LS		\$2,456
Contingencies (10%)	1.00	LS		\$4,911
Total + Mobilization and Contingencies				\$56,479

Table 16.3
SITE 16 ALTERNATIVE 2

Pay Item Description	Estimated Quantity	Unit	Unit Bid Price	Bid Amount
Excavation	1800.00	CY	15.00	\$27,000
Bank stabilization with Brush Matting	630.00	SY	15.00	\$9,450
Site Preparation and Planting	0.13	Ac	7500.00	\$975
Silt Fence	750.00	LF	3.75	\$2,813
Boulders	25.00	Tons	200.00	\$5,000
Construction Safety Fence	550.00	LF	2.50	\$1,375
Construction Entrance	1.00	Ea	2500.00	\$2,500
Bio-Retention Area with Underdrain	2061.00	CF	12.62	\$26,010
Total				\$75,122
Mobilization (5%)	1.00	LS		\$3,756
Contingencies (10%)	1.00	LS		\$7,512
Total + Mobilization and Contingencies				\$86,391

Maintenance Costs

Maintenance (5% of base construction cos of BMP)	1.0	Year		\$1,300
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ESTES DR EXT

N GREENSBORO ST

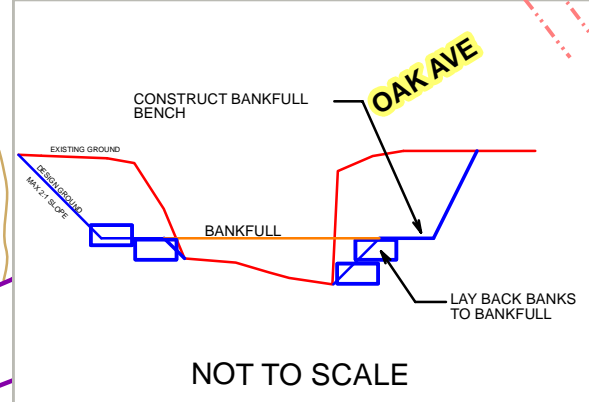
ALTERNATIVE 2: CONSTRUCT SMALL BIO-RETENTION AREA

ALTERNATIVE 1: USE STEP POOL TO GRADE DOWN TO BED OF RECEIVING STREAM

STABILIZE BOTH BANKS WITH BRUSH MATTING

STABILIZE BOTH BANKS WITH BRUSH MATTING AND LAY BACK BANKS WITH BANKFULL BENCH

CONCEPTUAL CROSS SECTION

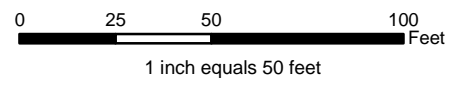


STABILIZATION AREAS

- Legend**
- Stormwater Lines
 - Impervious Surfaces
 - Perennial Stream
 - Intermittent Stream
 - Ephemeral Stream
 - Stream, unknown flow
 - Contours



CONCEPTUAL PLAN VIEW
 BOLIN CREEK WATERSHED
 Geomorphic Analysis and Potential Site
 Identification For
 Stormwater Structures and Retrofits





SITE 16

ESTES DR EXT

ALTERNATIVE 2: CONSTRUCT SMALL BIO-RETENTION AREA

ALTERNATIVE 1: USE STEP POOL TO GRADE DOWN TO BED OF RECEIVING STREAM

STABILIZE BOTH BANKS WITH BRUSH MATTING

STABILIZE BOTH BANKS WITH BRUSH MATTING AND LAY BACK BANKS WITH BANKFULL BENCH

INGRENSBORO ST

CONCEPTUAL CROSS SECTION

OAK AVE

CONSTRUCT BANKFULL BENCH

BANKFULL

LAY BACK BANKS TO BANKFULL

NOT TO SCALE

STABILIZATION AREAS

Legend

- Stormwater Lines
- Perennial Stream
- Intermittent Stream
- - - Ephemeral Stream
- · - · Stream, unknown flow



AERIAL PHOTO VIEW

BOLIN CREEK WATERSHED
Geomorphic Analysis and Potential Site Identification For Stormwater Structures and Retrofits

